



# Voluntary Product Standard

PS 62-74

U.S. DEPARTMENT OF COMMERCE/National Bureau of Standards

## GRADING OF DIAMOND POWDER IN SUB-SIEVE SIZES



American National  
Standards Institute

American National Standard Z 300.1-1974

UNITED STATES DEPARTMENT OF COMMERCE • Frederick B. Dent, *Secretary*

NATIONAL BUREAU OF STANDARDS • Richard W. Roberts, *Director*

## **VOLUNTARY PRODUCT STANDARD PS 62-74**

### **Grading of Diamond Powder in Sub-Sieve Sizes**

Approved by the American National Standards Institute on  
October 16, 1974, as American National Standard Z 300.1-1974

#### **Abstract**

This Voluntary Product Standard covers the quality requirements of sub-sieve sizes of diamond powder and establishes the standard particle size ranges for micron sizes. It establishes size designations of the size ranges and the grading limits that are acceptable in each size range. It also gives a method of inspection to determine compliance with this standard and directions for the labeling of powder to indicate such compliance.

Key words: Diamond powder, grading; sizes, sub-sieve of diamond powder; powder, diamond; grading of diamond powder.

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## **Grading of Diamond Powder in Sub-Sieve Sizes**

**Effective October 16, 1974 (See section 6.)**

(This Standard, which was initiated by the Industrial Diamond Association of America, Inc., has been developed under the *Procedures for the Development of Voluntary Product Standards* of the U.S. Department of Commerce. See Section 8, *History of Project*, for further information.)

### **1. PURPOSE**

The purpose of this Voluntary Product Standard is to provide a nationally recognized standard for the sizing of diamond powder in sub-sieve (micron) sizes and a uniform method of determining conformance with the size designated. It serves as a common basis for understanding between purchasers and sellers as to the quality and particle size desired or supplied, and thereby should promote fair competition.

### **2. SCOPE**

This Voluntary Product Standard covers the quality requirements of sub-sieve sizes of diamond powder and establishes the standard particle size ranges for micron sizes. It establishes size designations of the size ranges and the grading limits that are acceptable in each size range. It also gives a method of inspection to determine com-

pliance with this standard and directions for the labeling of powder to indicate such compliance.

### **3. REQUIREMENTS**

**3.1. General**—All diamond powder labeled or otherwise designated or represented as complying with this Voluntary Product Standard shall meet or exceed all of the requirements given herein.

**3.2. Material**—The powder shall consist of crushed diamond, cleaned of impurities so as to satisfy 3.6.

**3.3. Standard sizes**—The standard size ranges, size designations, and size tolerances are given in table 1. Intermediate sizes may also be labeled as conforming to this standard if the powder complies in all other respects to this standard, and provided the exact size range and maximum oversize is clearly stated on the label or certificate as shown in 7.3.

**TABLE 1.<sup>a</sup> Standard micron sizes of diamond powder**

Size designation	Nominal particle size range	Maximum oversize particles		Tolerance
		microns	microns	
½	0 to 1 -----		1½	Particles smaller than the minimum for each size range shall not be present in an amount more than 30 percent by count.
1	0 to 2 -----		3	
3	2 to 4 -----		5	
6	4 to 8 -----		10	
9	8 to 12 -----		14	
15	12 to 22 -----		25	Particles larger than the largest size of the nominal particle size range shall be avoided. They shall, however, be permissible up to the maximum oversize shown, but limited to a maximum amount by count of 5 percent up to and including grade 9, 3 percent for grades 15 and
30	22 to 36 -----		40	5 percent up to and including grade 9, 3 percent for grades 15 and
45	36 to 54 -----		58	30, and 2 percent for coarser grades.
60	54 to 80 -----		85	

<sup>a</sup> 1 micron = 1μm = 10<sup>-6</sup>m.

**3.4. Slivers**—The micron sizes shall not contain any slivers that are longer than twice the maximum oversize for any specified size range but may contain up to 3 percent by count of slivers that have lengths between the nominal maximum and twice the maximum oversize.

**3.5. Shales**—The micron sizes shall contain not more than 10 percent by count of shales, disregarding fines.

**3.6. Impurities**—A maximum of 2 percent by weight of impurities is permitted.

#### 4. METHOD OF INSPECTION

**4.1. Sampling**—A representative sample for chemical and microscopic examination may be obtained by thoroughly mixing the powder and carefully removing the desired amount with a micro-spatula.

**4.2. Particle size determination**—A small dab of Canada balsam is placed on a clean glass slide and a representative sample of the diamond powder is carefully placed on top of it with a micro-spatula. Care should be taken to avoid excess balsam as segregation of sizes may occur if too much is squeezed out when the cover glass is applied. The slide is then gently heated and as the balsam softens and spreads the powder is stirred into it. When the particles are evenly dispersed a cover glass is applied. When the slide has cooled it may be cleaned with an appropriate solvent. The slide is then placed under a microscope or projection microscope at a suitable magnification. (It is suggested that a magnification of at least 1000 power, using oil immersion techniques be used for standard size ranges  $\frac{1}{2}$ , 1, 3, 6, and 9; at least 400 power for standard size ranges 15 and 30; and at least 100 power for standard size ranges 45 and 60.) The size of a particle is determined by selecting a circle equivalent in area to it. When a microscope is used a graticule with a series of circles on it may be fitted into the eyepiece and when a projection microscope is used the circles may be on a transparent sheet. All the particles within a given area are measured and a sufficient number of areas included to enable a distribution curve to be drawn (at least 300 particles). Particles suspected of being slivers and shales shall also be measured and counted.

**4.3 Determination of impurities**—An accurately weighed sample of approximately 5 carats is first digested with 5 to 10 ml of hot bichromate cleaning solution. After the digestion is complete, the diamond powder is settled by centrifuging and the cleaning solution decanted. The powder is then washed with not less than five 10 ml portions of distilled water, centrifuged, and decanted between washings without loss of diamond powder. The final decanted portion of water should

be colorless. This cleaning procedure will remove organic impurities such as oils, greases or lint.

The remaining sample is then digested at room temperature with 5 to 10 ml of 10-percent hydrochloric acid, settled, decanted, and washed, followed by digestion with 5 to 10 ml of 10-percent nitric acid, after which it is again settled and washed at least three times. The moist powder is then transferred to a clean platinum dish or crucible and 10 to 15 drops of diluted sulfuric acid (1-1) and 10 ml of hydrofluoric acid (40 percent) are added. Evaporate the sulfuric acid on a sand bath or hot plate. Care should be taken to avoid loss by spattering. Cool the dish, add a few drops of water, 5 ml of hydrofluoric acid (40 percent), and repeat the evaporation until all sulfuric acid has been expelled. Cover the dish, transfer to a desicator, cool, and weigh. The percentage loss in weight of the sample represents the organic and inorganic impurities removed by the above procedure excepting sulphates such as a calcium or barium sulphate or other materials insoluble in the above acids or water, including traces of substances highly resistant to acids.

If it is suspected that such contaminants may still be present, the weighed acid cleaned sample shall then be treated by a combustion method; it shall be burnt in oxygen generally in accordance with accepted methods of determining carbon in steel. For this purpose the sample is placed on a porcelain boat and after burning in a stream of oxygen the carbon dioxide absorbed in a suitable alkaline absorber is weighed and from it the remaining impurities are calculated. (The ash remaining on the porcelain boat may be weighed to check the result obtained by the combustion. Consideration should be made for slight differences in the results of carbon analysis between the two methods.)

#### 5. DEFINITIONS

The terminology used herein is defined for purposes of this standard as follows:

**Micron sizes**—Those sizes of diamond powder usually prepared by methods of separation other than by sieving, mainly Stokesian, and usually smaller than the sieve sizes.

**Particle size**—The particle size is equal to the diameter of a circle having the same area as the profile of the particle when viewed with a microscope.

**Fines or undersize particles**—Fines (undersize particles) are any particles smaller than the minimum for any specified size.

**Slivers**—A sliver is a particle of needle or rodlike shape such that the ratio of the major to the minor axes is greater than 3 to 1.

**Shales**—A shale is a particle of thin platelike shape, which when viewed through a microscope using transmitted light, appears to be transparent.

## **6. EFFECTIVE DATE**

The effective date of this Standard is October 16, 1974. As of the effective date, reference to PS 62-74, may be made in contracts, codes, advertising, invoices, product labels, and the like, but no product may be advertised or represented in any manner which would imply or tend to imply approval or endorsement of that product by the National Bureau of Standards, the Department of Commerce, or by the Federal Government.

## **7. IDENTIFICATION**

**7.1. Preferred method**—In order to assure the purchaser that he is getting diamond powder which meets all of the requirements of the standard, it is recommended that manufacturers declare compliance with this Standard by means of the following statement on labels, invoices, sales literature, etc., in conjunction with their name or trademark:

This diamond powder is in conformance with all requirements of Voluntary Product Standard PS 62-74, as developed by the trade under the procedure of the Standards Development Services Section, National Bureau of Standards, United States Department of Commerce.

Particle size \_\_\_\_\_

Name or Trademark of Manufacturer \_\_\_\_\_

**7.2. Alternate method**—Where space is limited, the following will suffice:

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Particle size \_\_\_\_\_

Name or Trademark of Manufacturer \_\_\_\_\_

**7.3. Exceptions**—Diamond powders of non-standard or intermediate size range but otherwise in full compliance with the requirements of the standard, may use a label essentially like the following:

## **Sample Label**

Nominal particle size range 20 to 30 microns  
Maximum oversize particle 33 microns  
This diamond powder is, except for the actual values shown above, in conformance with all requirements of Voluntary Product Standard PS 62-74, as developed by the trade under the procedures of the Standards Development Services Section, National Bureau of Standards, U.S. Department of Commerce.

Name or Trademark of Manufacturer \_\_\_\_\_

## **8. HISTORY OF PROJECT**

In a letter dated November 8, 1960, the Industrial Diamond Association of America, Inc. (IDA), requested the cooperation of the Commodity Standards Division, Office of Technical Services (now Standards Development Services Section), National Bureau of Standards, in the establishment of a Commercial Standard for Grading of Diamond Powder in Sub-Sieve Sizes. The IDA requested that the new standard supersede that portion of CS 123-49 which applied to sub-sieve sizes, and a new Standing Committee was appointed. After the IDA draft was edited by the Division, it was reviewed for technical adequacy and accuracy by the National Bureau of Standards. Major adjustments were suggested in the testing procedure, and the revised draft was submitted to the new Standing Committee for consideration on May 3, 1962. Many suggestions were received and were resolved by the IDA. A recommended Commercial Standard TS 5633 was widely circulated to the trade on June 17, 1963 for final approval. According to the IDA, the manufacturers who accepted the standard produce over 85 percent of this commodity. Therefore, in the absence of valid objections, CS 261-63, was announced on August 20, 1963, to become effective for new production on September 20, 1963. The standard was revalidated and published as a Voluntary Product Standard PS 62-74, with an effective date of October 16, 1974.

### *Technical Standards Coordinator:*

Charles W. Devereux, Standards Development Services Section, National Bureau of Standards, Washington, D.C. 20234

## **9. STANDING COMMITTEE**

A Standing Committee has been appointed to assist in keeping this Voluntary Product Standard up to date. The names of the members of the committee are available from the Standards Development Services Section, National Bureau of Standards, Washington, D.C. 20234, which serves as the secretariat for the committee.



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## **VOLUNTARY PRODUCT STANDARDS**

*Voluntary Product Standards* are developed under procedures published by the Department of Commerce in Part 10, Title 15, of the Code of Federal Regulations. The purpose of the standards is to establish nationally recognized requirements for products, and to provide all concerned interests with a basis for common understanding of the characteristics of the products. The National Bureau of Standards administers the *Voluntary Product Standards* program as a supplement to the activities of the private sector standardizing organizations.

### **Establishment of a VOLUNTARY PRODUCT STANDARD**

The role of the National Bureau of Standards in the establishment of a *Voluntary Product Standard* is to (1) act as an unbiased coordinator in the development of the standard, (2) provide editorial assistance in the preparation of the standard, (3) supply such assistance and review as is required to assure the technical soundness of the standard, (4) seek satisfactory adjustment of valid points of disagreement, (5) determine the compliance with the criteria of the Department's procedures, (6) provide secretarial functions for each committee appointed under the Department's procedures, and (7) publish the standard as a public document.

Producers, distributors, users, consumers, and other interested groups contribute to the establishment of a *Voluntary Product Standard* by (1) initiating and participating in the development of the standard, (2) providing technical or other related counsel as appropriate relating to the standard, (3) promoting the use of and support for the standard, and (4) assisting in keeping the standard current with respect to advancing technology and marketing practices.

### **Use of a VOLUNTARY PRODUCT STANDARD**

The use of a *Voluntary Product Standard* is voluntary; the National Bureau of Standards has no regulatory power in the enforcement of the provisions of the standards. However, since the standards represent a consensus of all interested groups, their provisions are likely to become established as trade customs. In addition, when a standard is made a part of a legal document, such as a sales contract or code, compliance with the standard is enforceable.

The benefits derived from *Voluntary Product Standards* are in direct proportion to their general recognition and actual use. Producers and distributors whose products meet the requirements of a Voluntary Product Standard may refer to the standard in advertising and on labels to promote greater public understanding of or confidence in their products. Purchasers may order products conforming to the requirements of the standards.

For copies of the *Voluntary Product Standards* procedures or for more information concerning the development and use of these standards, you may write to: Standards Development Services Section; National Bureau of Standards; Washington, D.C. 20234.



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The National Bureau of Standards<sup>1</sup> was established by an act of Congress March 3, 1901. The Bureau's overall goal is to strengthen and advance the Nation's science and technology and facilitate their effective application for public benefit. To this end, the Bureau conducts research and provides: (1) a basis for the Nation's physical measurement system, (2) scientific and technological services for industry and government, (3) a technical basis for equity in trade, and (4) technical services to promote public safety. The Bureau consists of the Institute for Basic Standards, the Institute for Materials Research, the Institute for Applied Technology, the Institute for Computer Sciences and Technology, and the Office for Information Programs.

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<sup>1</sup> Headquarters and Laboratories at Gaithersburg, Maryland, unless otherwise noted; mailing address Washington, D.C. 20234.

<sup>2</sup> Part of the Center for Radiation Research.

<sup>3</sup> Located at Boulder, Colorado 80302.

<sup>4</sup> Part of the Center for Building Technology.

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